

WHAT IS CLAIMED IS:

1. A semiconductor device comprising a thin-film transistor formed over a substrate, said semiconductor device comprising:
 - 5 a base film formed in contact with one surface of an active layer of said thin-film transistor;
 - a gate insulating film formed in contact with the other surface of said active layer;
 - 10 a gate electrode formed in contact with said gate insulating film; and
 - an interlayer insulating film formed over said gate electrode, wherein at least one of the group consisting of said base film, said gate insulating film, and said interlayer insulating film is formed from a hydrogenated silicon oxynitride film comprising an oxygen concentration from 55 to 70 atomic%, a nitrogen concentration from 0.1 to 6 atomic%, and a hydrogen concentration from 0.1 to 3 atomic%.
- 15 2. The semiconductor device according to claim 1, wherein said semiconductor device is one selected from the group consisting of a personal computer, a video camera, a portable information terminal, a digital camera, a digital video disk player, an electronic game equipment, and a projector.
- 20 3. The semiconductor device according to claim 1, wherein said semiconductor device is an EL display device.
4. A semiconductor device comprising a thin-film transistor formed over a substrate, 25 said semiconductor device comprising:
 - a base film formed in contact with one surface of an active layer of said thin-film transistor;
 - a gate insulating film formed in contact with the other surface of said active layer;

a gate electrode formed in contact with said gate insulating film; and
an interlayer insulating film formed over said gate electrode,
wherein at least one layer of an insulating film forming said base film, said gate
insulating film, and said interlayer insulating film, is formed from a hydrogenated silicon
5 oxynitride film comprising an oxygen concentration from 55 to 70 atomic%, a nitrogen
concentration from 0.1 to 6 atomic%, and a hydrogen concentration from 0.1 to 3
atomic%.

5. The semiconductor device according to claim 4, wherein said semiconductor
10 device is one selected from the group consisting of a personal computer, a video camera,
a portable information terminal, a digital camera, a digital video disk player, an electronic
game equipment, and a projector.

6. The semiconductor device according to claim 4, wherein said semiconductor
15 device is an EL display device.

7. A semiconductor device comprising a thin-film transistor formed over a substrate,
said thin-film transistor comprising:

a gate insulating film formed in contact with one surface of an active layer of said
20 thin-film transistor;

a gate electrode formed in contact with said gate insulating film; and
a protective insulating film or an interlayer insulating film formed over the other
surface of said active layer,

wherein at least one of the group consisting of said gate insulating film, and said
25 protective insulating film or said interlayer insulating film, is formed from a hydrogenated
silicon oxynitride film comprising an oxygen concentration from 55 to 70 atomic%, a
nitrogen concentration from 0.1 to 6 atomic%, and a hydrogen concentration from 0.1 to
3 atomic%.

8. The semiconductor device according to claim 7, wherein said semiconductor device is one selected from the group consisting of a personal computer, a video camera, a portable information terminal, a digital camera, a digital video disk player, an electronic game equipment, and a projector.

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9. The semiconductor device according to claim 7, wherein said semiconductor device is an EL display device.

10. A semiconductor device comprising a thin-film transistor formed over a substrate, said thin-film transistor comprising:

a gate insulating film formed in contact with one surface of an active layer of said TFT;

a gate electrode formed in contact with said gate insulating film; and

15 a protective insulating film or an interlayer insulating film formed over the other surface of said active layer,

wherein at least one layer of an insulating film forming said gate insulating film, and said protective insulating film or said interlayer insulating film, is formed from a hydrogenated silicon oxynitride film comprising an oxygen concentration from 55 to 70 atomic%, a nitrogen concentration from 0.1 to 6 atomic%, and a hydrogen concentration 20 from 0.1 to 3 atomic%.

11. The semiconductor device according to claim 10, wherein said semiconductor device is one selected from the group consisting of a personal computer, a video camera, a portable information terminal, a digital camera, a digital video disk player, an electronic game equipment, and a projector.

12. The semiconductor device according to claim 10, wherein said semiconductor device is an EL display device.

13. A method of manufacturing a semiconductor device comprising a thin-film transistor formed over a substrate, comprising the steps of:

forming a base film in contact with one surface of an active layer of said thin-film transistor;

5 forming a gate insulating film in contact with the other surface of said active layer;

forming a gate electrode in contact with said gate insulating film; and

forming an interlayer insulating film over said gate electrode,

wherein in at least one of said steps, a hydrogenated silicon oxynitride film is formed
10 from SiH₄, N₂O, and H₂.

14. The method of manufacturing a semiconductor device according to claim 13, wherein hydrogen contained in at least said hydrogenated silicon oxynitride film is diffused into said active layer by a heat treatment.

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15. The method of manufacturing a semiconductor device according to claim 14, wherein a temperature of said heat treatment is in a range of 300 to 500 °C.

16. The method of manufacturing a semiconductor device according to claim 13,
20 wherein a flow rate of H₂ is in the range of 0.1 to 7 times the sum of flow rates of SiH₄ and N₂O for the formation of the hydrogenated silicon oxynitride film.

17. The method of manufacturing a semiconductor device according to claim 13, wherein said hydrogenated silicon oxynitride film comprises an oxygen concentration from
25 55 to 70 atomic%, a nitrogen concentration from 0.1 to 6 atomic%, and a hydrogen concentration from 0.1 to 3 atomic%.

18. The method of manufacturing a semiconductor device according to claim 13, wherein said semiconductor device is one selected from the group consisting of a personal

computer, a video camera, a portable information terminal, a digital camera, a digital video disk player, an electronic game equipment, and a projector.

19. The method of manufacturing a semiconductor device according to claim 13,
5 wherein said semiconductor device is an EL display device.

20. A method of manufacturing a semiconductor device comprising a thin-film transistor formed over a substrate, comprising the steps of:

10 forming a base film in contact with one surface of an active layer of said thin-film transistor;

forming a gate insulating film in contact with the other surface of said active layer;

forming a gate electrode in contact with said gate insulating film; and

15 forming an interlayer insulating film over said gate electrode,

wherein at least one layer of said insulating films formed in said steps is formed of a hydrogenated silicon oxynitride film manufactured from SiH_4 , N_2O , and H_2 .

21. The method of manufacturing a semiconductor device according to claim 20,
wherein hydrogen contained in at least said hydrogenated silicon oxynitride film is diffused
20 into said active layer by a heat treatment.

22. The method of manufacturing a semiconductor device according to claim 21,
wherein a temperature of said heat treatment is in a range of 300 to 500 °C.

25 23. The method of manufacturing a semiconductor device according to claim 20,
wherein a flow rate of H_2 is in the range of 0.1 to 7 times the sum of flow rates of SiH_4 and N_2O for the formation of the hydrogenated silicon oxynitride film.

24. The method of manufacturing a semiconductor device according to claim 20,

wherein said hydrogenated silicon oxynitride film comprises an oxygen concentration from 55 to 70 atomic%, a nitrogen concentration from 0.1 to 6 atomic%, and a hydrogen concentration from 0.1 to 3 atomic%.

5 25. The method of manufacturing a semiconductor device according to claim 20, wherein said semiconductor device is one selected from the group consisting of a personal computer, a video camera, a portable information terminal, a digital camera, a digital video disk player, an electronic game equipment, and a projector.

10 26. The method of manufacturing a semiconductor device according to claim 20, wherein said semiconductor device is an EL display device.

15 27. A method of manufacturing a semiconductor device comprising a thin-film transistor formed over a substrate, comprising the steps of:

15 forming a gate insulating film in contact with one surface of an active layer of said thin-film transistor;

 forming a gate electrode in contact with said gate insulating film; and

 forming a protective insulating film or an interlayer insulating film in contact with the other surface of said active layer,

20 wherein in at least one of said steps, a hydrogenated silicon oxynitride film is formed from SiH_4 , N_2O , and H_2 .

25 28. The method of manufacturing a semiconductor device according to claim 27, wherein hydrogen contained in at least said hydrogenated silicon oxynitride film is diffused into said active layer by a heat treatment.

29. The method of manufacturing a semiconductor device according to claim 28, wherein a temperature of said heat treatment is in a range of 300 to 500 °C.

30. The method of manufacturing a semiconductor device according to claim 27, wherein a flow rate of H₂ is in the range of 0.1 to 7 times the sum of flow rates of SiH₄ and N₂O for the formation of the hydrogenated silicon oxynitride film.

5 31. The method of manufacturing a semiconductor device according to claim 27, wherein said hydrogenated silicon oxynitride film comprises an oxygen concentration from 55 to 70 atomic%, a nitrogen concentration from 0.1 to 6 atomic%, and a hydrogen concentration from 0.1 to 3 atomic%.

10 32. The method of manufacturing a semiconductor device according to claim 27, wherein said semiconductor device is one selected from the group consisting of a personal computer, a video camera, a portable information terminal, a digital camera, a digital video disk player, an electronic game equipment, and a projector.

15 33. The method of manufacturing a semiconductor device according to claim 27, wherein said semiconductor device is an EL display device.

34. A method of manufacturing a semiconductor device comprising a thin-film transistor formed over a substrate, comprising the steps of:

20 forming a gate insulating film in contact with one surface of an active layer of said thin-film transistor;

 forming a gate electrode in contact with said gate insulating film; and

 forming a protective insulating film or an interlayer insulating film in contact with said other surface of said active layer,

25 wherein at least one layer of the insulating films formed in said steps is formed of a hydrogenated silicon oxynitride film manufactured from SiH₄, N₂O, and H₂.

35. The method of manufacturing a semiconductor device according to claim 34, wherein hydrogen contained in at least said hydrogenated silicon oxynitride film is diffused

into said active layer by a heat treatment.

36. The method of manufacturing a semiconductor device according to claim 35, wherein a temperature of said heat treatment is in a range of 300 to 500 °C.

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37. The method of manufacturing a semiconductor device according to claim 34, wherein a flow rate of H₂ is in the range of 0.1 to 7 times the sum of flow rates of SiH₄ and N₂O for the formation of the hydrogenated silicon oxynitride film.

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38. The method of manufacturing a semiconductor device according to claim 34, wherein said hydrogenated silicon oxynitride film comprises an oxygen concentration from 55 to 70 atomic%, a nitrogen concentration from 0.1 to 6 atomic%, and a hydrogen concentration from 0.1 to 3 atomic%.

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39. The method of manufacturing a semiconductor device according to claim 34, wherein said semiconductor device is one selected from the group consisting of a personal computer, a video camera, a portable information terminal, a digital camera, a digital video disk player, an electronic game equipment, and a projector.

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40. The method of manufacturing a semiconductor device according to claim 31, wherein said semiconductor device is an EL display device.